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N. G. Menon and P. P. Pillai

Central Marine Fisheries Research Institute, Cochin

The Marine Biological Association of India

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Hatchery production of the clownfish *Amphiprion chrysogaster*

G. Gopakumar, Rani Mary George and S. Jasmine
Vizhinjam Research Centre of C.M.F.R.I., Vizhinjam - 695521

ABSTRACT

Tropical marine aquarium fishes have demand in the international market. Clownfishes or anemonefishes are most popular among marine aquarists due to their attractive colours and interesting display of behaviour with sea anemones. A technology for the hatchery production of the clownfish, Amphiprion chrysogaster *was developed for the first time in India. The broodstock maintained in the hatchery spawned frequently and methods were developed for hatching the eggs. The hatching period was 6-7 days. A simple biological detoxifying filtration system with effective circulation was designed and fabricated for larval rearing. The larvae were fed with the rotifer* Brachionus rotundiformis *at a*

concentration of 6-8 numbers per ml for the first four days. From the fifth day onwards they were fed with a mixture of B. rotundiformis *and freshly hatched* Artemia *nauplii. The larvae metamorphosed into juveniles in 12 to 15 days from the day of hatching. The juveniles were kept in the rearing tank for one week to one month by feeding them with* Moina micrura *and then transferred to grow out tanks with sea anemones. By upscaling the present technology, large scale hatchery production of clownfish young ones could be achieved.*

Introduction

The marine ornamental fish trade is rapidly expanding and tropical marine aquarium fishes are in great demand in the international market. About 15% of the world aquarium fish industry is constituted by marine aquarium fishes and more than 90% of these fishes are contributed from countries like Singapore, Hong Kong, Sri Lanka and Maldives. Eventhough India has a vast potential of marine ornamental fishes, an organised marine ornamental fish trade has not yet been developed in the country.

It is well known that the marine ornamental fishes are mostly associated with coral seas. The coral reefs provide a variety of ecological niche which are the abode of extremely rich and complicated animal communities consisting of a great diversity of species. By virtue of the shapes and bright colour patterns these fishes are attractive and many of them can be grouped as ornamental fishes. More than fifty reef fish families consisting of nearly 175 genera and about 400 species of ornamental fishes are distributed in the Indian seas. The major oceanic areas of coral fish distribution in Indian are the Lakshadweep Islands and the Andaman-Nicobar groups of Islands. The other areas of coral fish distribution are the coastal areas of fringing or patchy reefs of Gulf of Kutch to Bombay, areas of central west coast between Bombay to Goa, certain locations at south west coast (Vizhinjam to Cape Comorin), Visakhapatnam area, Gulf of Mannar and Palk Bay. The indiscriminate exploitation of these areas for the collection of ornamental fishes can cause severe damage to the delicate coral reef ecosystem. Hence it is evident that the exploitation of marine ornamental fishes from the wild should be done rationally purely on the basis of scientific management regime without inflicting any damage to the ecosystem.

The clownfishes belonging to the family Pomacentridae are among the most popular tropical marine ornamental fishes due to their generally small and hardy nature, attractive colours, high adaptability to life in captivity and the interesting disply of behaviour due to their association with sea anemones. The breeding of clownfishes has fascinated many marine aquarists

and some of the species were successfully bred and reared under captive conditions. The breeding and rearing of marine ornamental fishes in India is still in its infancy and successful technologies for the hatchery production of marine ornamental fishes are yet to be developed. In this context, the captive breeding and hatchery production of the clownfishes *Amphiprion chrysogaster* was attempted.

Materials and methods

The broodstock of *A. chrysogaster* was developed by collecting the fish along with the anemone belonging to the genus *Stoichactis* from Tuticorin/ Mandapam area. They were kept in 2.5 m x 0.6 m x 0.6 m glass aquarium tanks as well as in rectangular FRP tanks (2.2 m x 1.2 m x 1.2 m) along with sea anemones. The tanks were installed with biological-filters. In each tank 4-6 numbers of fishes were introduced. They were fed with boiled mussel meat two times daily. The eggs were removed carefully without exposing to air and were hatched in 100 litre FRP tanks containing filtered sea water from a biological filter. The eggs were continuously aerated by adjusting the position of the air stone so as to create the effect of fanning the eggs by the parents. Eggs were also hatched by keeping them in the parental tank itself till hatching. The newly hatched larvae were carefully removed by siphoning or transferring in small buckets. The larval rearing tanks (100 to 200 litres capacity) were provided with special type of filtration system. The water from an overhead tank with biological filter was re-circulated through the larval rearing tanks. The water circulation in the larval raring tanks were effected through fine pores put at the bottom of PVC pipes which were placed inside the rearing tanks. The filtration rate was adjusted around 100% per hour. The larvae were fed with the rotifer *Brachionus rotundiformis* at a concentration of 6-8 numbers for the first four days. From the fifth day onwards they were fed with a mixture of *B. rotundiformis* and freshly hatched *Artemia* nauplii. The young ones were fed with *Moina micrura*.

Results

Broodstock development

In all the broodstock tanks one pair grew ahead of others and became the spawning pair. The size of the mature fish ranged between 8-9 cm. Sexual dichromatizem was noted in the spawning pair. The snout of the female was dusky yellow whereas that of the male was bright yellow.

Spawning

The fish spawned several times in the broodstock tanks. The spawning pair drove out other fishes intruding into their territory. The spawning started with the cleaning of the substratum at which the eggs were to be

laid. Then the egg laying started which lasted for about an hour. The spawning took place invariably during 0900 to 1400hrs. The eggs were attached to small earthen pots, granite stones, on the sides of the broodstock tanks and even to the PVC pipes of the biological filter of the tank. The number of eggs at a single spawning ranged from 300 - 800. The interval between successive spawning of a pair varied between 10 days to 45 days. Both the parents continuously guarded the eggs and fanned the eggs with their fins and mouth.

The freshly laid fertilised egg was orange in colour and it started swelling within a few hours. The eggs were stalked, capsule shaped and the length ranged from 1.7 to 2.9 mm. A bright silvery spot inside the egg was obvious through the egg capsule. The unfertilised eggs were more orange in colour and they remained thin.

Hatching the eggs

The eggs started darkening from the second day and the developing larvae were clearly visible through the egg capsule from the third to fourth day. The larval hatching period was between 6 and 7 days. On the day of hatching the egg capsules became very thin and transparent. Glowing of the larval eyes was prominent. The larvae broke the capsules and came out. Darkness accelerated the hatching process. The mass hatching of the eggs occurred during night with peak during 1900 to 2200 hrs. In most cases 60 - 70% of the viable eggs hatched on the same night. But in a few cases half of the eggs hatched on the next day night. The hatching rate obtained was above 90% in the method of keeping the eggs in the parental tank itself till hatching, whereas the hatching rate was below 50% in the case of eggs incubated without parental care. The viability of the eggs was highly variable. The non-viable eggs became white from the third day of incubation.

Larval rearing

The length of the newly hatched larvae ranged from 2.5 to 3 mm (mouth gape varied from 200 to 250 μm). The larval survival after the critical period (after fifth day from the day of hatching) ranged from 50 - 60%. Contamination with unhatched *Artemia* cysts was detrimental to larval survival. When this factor was checked there was no further mortality. The larvae metamorphosed into juveniles in 12 to 15 days from the day of hatching. The average length of just metamorphosed young one was 8 mm. In the first batch 40 numbers of clownfish juveniles were produced at Vizhinjam by employing the same methodology.

Discussion

The exploitation of marine ornamental fish from the wild would lead to the overexploitation of the coral seas. The indiscriminate methods of harvest can damage the coral reef ecosystem, which provides the microhabitat requirement for the recruitment of the different species of coral reef fishes. Hence the only option to meet their demand is the hatchery production.

Several studies have been made on the biology of clownfishes (Moyer and Bell, 1978; Moyer and Nakazono, 1978; Moyer, 1980; Ochi, 1986; Hattori and Yanagisawa, 1991 a,b; Nelson *et al.*, 1996). They are benthic egg layers and protandrous hermaphrodites. Social hierarchies in anemonefish were also studied in detail (Moyer, 1976; Moyer and Nakazono, 1978; Hattori and Yanagisawa, 1991b). The largest individual in an anemone is usually a female with a smaller male and a variable number of juveniles. The anemonefishes show considerable aggression towards other individuals present in the anemone. Hirose (1995) studied the patterns of pair formation in *A. clarkii, A. frenatus and A. perideraion* on coral reefs of Okinawa, Japan which indicated that re-pairing occurred in these species. The results of the experiments on population restocking were found to be encouraging (Nelson *et al.*, 1996). Hattori and Yamamura (1995) described the coexistence of sub adult males and females as alternative tactics for breeding post acquisition in *A. clarkii*. The salient aspects of biology of *A. chrysogaster* agree with the general pattern noted in the other clownfish species studied.

The breeding and rearing of anemonefishes is promising due to the production of large eggs and larvae, frequent spawning in captivity and the hardy nature of the fish. The breeding and rearing of two species of clownfish viz, *A. clarkii and A. percula* was reported by Alva and Gomes (1989). Several fish hobbyists were able to breed different species of clownfishes. Malpass (1996) described the details of raising *A. percula*. Allen (1998) reported on the clownfish hatchery production by two companies connected with marine aquarium hobby. The species they reared were *A. percula, A. melanopus, A. perideraion, A. ocellaris, A. frenatus* and *Premnas biaculeatus*. There has been no report on the breeding and rearing of clownfishes from Indian waters.

The major technological aspects of clownfish rearing programme are the successful development of broodstock, methods of hatching the eggs, development of a biological detoxifying filtration system for larval rearing and appropriate larval feeding schedule. It is felt that by upscaling the present technology large scale hatchery production of clownfish young ones for export market could be achieved. This technology can be considered as a milestone towards the development of a marine ornamental fish trade in India, which

has immense potential for foreign exchange earning. Besides, this technology can also pave the way for the development of suitable techniques for the larval rearing of valuable marine food fishes in hatcheries.

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